Idaho State Department of Agriculture
Division of Agricultural Resources

Agricultural Ground Water Quality Monitoring Results of Northwest Ada County

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ISDA Technical Results Summary #3

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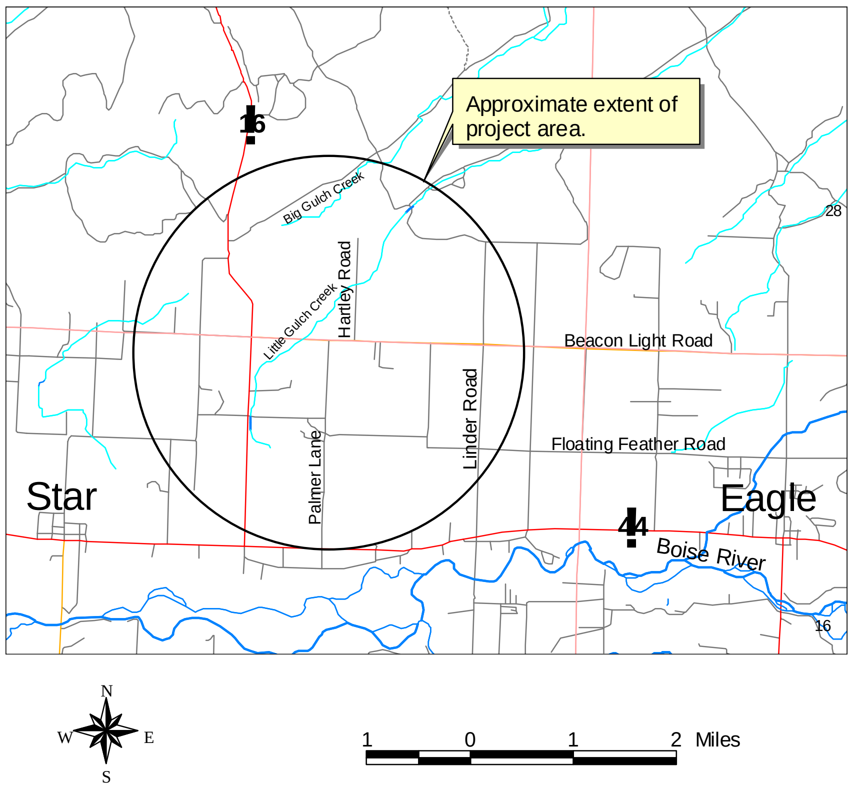

Figure 1. Location of local ground water monitoring project area.

Introduction

From March 1995 to November 1995, the Idaho State Department of Agriculture (ISDA) sampled 36 domestic wells for pesticides, volatile organics compounds (VOCs), and nitrate in an area northeast of Star, Idaho (Figure 1). Monitoring in the area was conducted in response to previous monitoring and concerns related to detections of these contaminants. Monitoring in 1993 by the Statewide Ambient Ground Water Quality Monitoring Program coordinated by the Idaho Department of Water Resources (IDWR) detected the pesticide dacthal from a homeowner's well in an area northwest of Eagle. In addition, prior studies in this area undertaken by IDWR and ISDA in 1991 and 1992, respectively, detected 2 volatile organic compounds associated with pesticides, 1,2-dichloropropane and 1,2,3-trichloropropane. In response to these findings, the ISDA Division of Agricultural Resources conducted a local ground water monitoring project to evaluate the extent of pesticides, VOCs, and nitrate in this area. The initial sampling included areas that were sampled during the 1991, 1992, and 1993 sampling efforts.

The first phase of monitoring in the spring of 1995 included 20 domestic wells. The first phase monitoring area is shown in Figure 1. The second phase of monitoring in the summer and fall of 1995 focused on an additional 16 domestic wells showing elevated concentrations of pesticides, nitrate, and VOCs from the first phase monitoring effort. The area involved in second phase monitoring was concentrated primarily near Hartley Road. The additional 16 wells were sampled to determine the geographic extent of the contamination, determine possible sources, and provide information to land and homeowners.

General Hydrogeology

The hydrogeology of northwest Ada County consists of an upper and lower aquifer composed of alternating layers of clay and sand separated by a thick clay layer. Such a stratigraphic sequence is indicative of fluvial deposition. A report by Thomas and Dion (1974) suggests that the lower aquifer is within the Glenns Ferry Formation of the Idaho Group, whereas the upper aquifer includes older terrace gravels, younger terrace gravels, and recent finer grained alluvial deposits. The direction of ground water movement is controlled largely by topography and surface drainage. Ground water movement in the monitoring area is to the southwest and follows topographic lows to the Boise River and other tributaries (Thomas and Dion, 1974).

Soils

Predominate soil type within the study area is the Feltham Series (Collett, 1980). This series is composed primarily of Feltham loamy fine sand with slopes ranging from 0-3% and 3-12%. This soil is very deep and rapidly drained. Permeability is rapid in the upper part of the profile and moderately rapid in the lower parts. The available water capacity is moderate. Runoff is slow and the hazard of erosion is slight.

In most areas, the soil is used for irrigated crops and pasture. The major crops are field corn, corn silage, mint, wheat, sugar beets, alfalfa, hay, barley, and potatoes. The rapid permeability is the major limitation to agriculture. Furrow, border, corrugation, and sprinkler irrigations systems are used on this land.

Methods

During phase one monitoring, 20 wells were sampled to determine if previously detected compounds of concern were still present in the wells tested during ISDA's (1991, 1992) and IDWR's (1993) original monitoring programs. Additional wells were chosen to help determine the extent of movement of previously detected compounds with emphasis to the west and southwest of the original detections. Well driller's reports from IDWR were reviewed for the study area. When possible, domestic wells with well drillers' reports were chosen for sampling. Most wells were chosen according to location and the ability to reach the homeowner for permission to sample. Thirteen of the sampled wells ranged from 40 to 110 feet in depth, two of the wells were 198 and 286 feet in depth. The remaining five wells had no information available.

For second phase monitoring in the summer and fall of 1995, ISDA chose 16 additional wells for sample collection. These wells were chosen based on their close proximity to the wells along Hartley Road that showed elevated detections during the initial monitoring program. Only a few well logs were available for the wells tested in this follow-up study. Most of the information on well construction came from information gathered from homeowners. Well depths for this second phase program ranged from 70 to 155 feet.

Sampling Procedures

Whenever feasible, ground water samples were collected from hydrants or outside faucets located as close as possible to the well head. Prior to sample collection, a minimum of three well volumes was purged and field measurements for specific conductance, total dissolved solids, pH, and temperature were taken at regular intervals until stable. Field measurements were considered stable when the last two measurements were within (+/-) 5 percent. Measurements for pH were taken using an Orion Model 210A meter. The meter was calibrated for linearity using buffers 7 and 10 prior to conducting measurements at each location. Total dissolved solids and conductivity measurements were taken using a temperature compensating Orion Model 124 meter.

Water samples for pesticide scans were collected in precleaned, amber glass bottles. Carbamate samples were collected in 125 milliliter (ml) amber glass bottles and preserved after receipt at the laboratory with monochloroacetic acid buffer. Nitrate samples were collected in 125 ml plastic containers. Samples for VOCs were collected in 40 ml glass vials equipped with Teflon lined septum caps. The vials were filled to slightly overflowing and securely capped. The vials then were inverted and tapped; the absence of entrapped air bubbles indicated a proper seal. Immediately after collection, the samples were stored within a cooler on ice to await shipment to the laboratory. All samples were shipped via air freight for same day or next day delivery.

Analytical Methods

Samples taken from the 20 wells were tested for 162 different analytes for the initial phase of this program. The Environmental Protection Agency (EPA) approved analytical methods used are as follows: Method 507-Nitrogen and Phosphorous Pesticides, Method 508-Chlorinated Pesticides, Method 515.1-Chlorinated Herbicides, Method 531.1-Carbamates/Carbamoyloximes, Method 524.2-Purgeable Organic Compounds and Method 353.2-Total Nitrate. For the follow-up phases of monitoring the analytical testing was limited to Methods 515.1, 524.2 and 353.3. The University of Idaho Analytical Sciences Laboratory, Holm Research Center located at Moscow, Idaho analyzed all samples during these programs.

Quality Assurance

All of the samples submitted to the laboratory were extracted and analyzed within the required holding times.

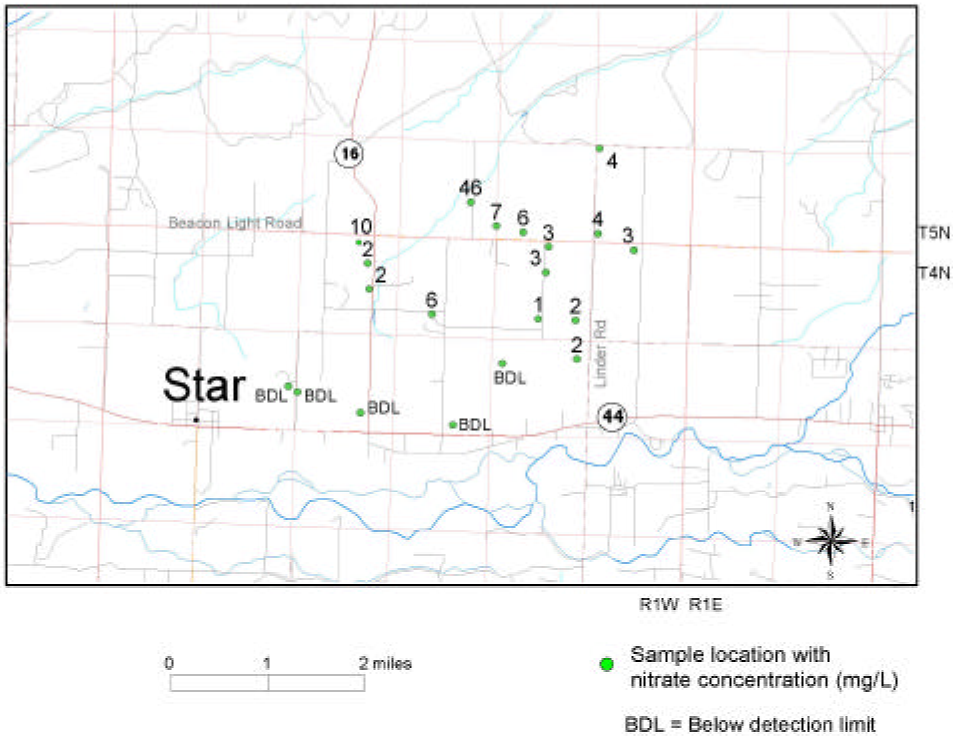

Figure 2. Map of nitrate concentrations in ground water determined from monitoring conducted by ISDA in the Spring of 1995.

During this local project, 10% of the samples were collected as blind duplicates and submitted to the laboratory with the original samples for analysis. Transfer and travel blanks were used relative to the volatile organic compound sampling. Also, additional liters of water were collected (at a rate of 10% of the total sample load) for pesticide matrix spike and matrix spike duplicate analysis.

Results

Nitrate + Nitrite as N

During the first phase, 15 out of 20 wells (75%) had nitrate detections above the laboratory detection limit of 0.33 milligrams per liter (mg/L). Only one concentration (46 mg/L) exceeded the EPA Maximum Contaminant Level (MCL) of 10 mg/L (Figure 2). Nitrate levels less than 2.0 mg/L are considered naturally occurring. Using this criteria, 12 out of the 20 wells showed some sign of impact (>2.0 mg/L) from nitrate. The mean nitrate level for the initial monitoring was 6.7 mg/L.

Nitrate testing results from second phase monitoring near Hartley Road showed that 15 out of 16 wells (94%) had positive detections for nitrate. A total of 56% of the wells (nine out of 16) had nitrate levels above the MCL of 10 mg/L established by the EPA (Figure 3 and Table 1). The mean concentration for nitrate from the follow-up monitoring was 16 mg/L.

Pesticides

Out of the 20 wells initially monitored, three wells tested positive for pesticides. Two of these wells showed positive detections for the pesticide dacthal (DCPA) and one well was positive for atrazine. Out of the two wells testing positive for dacthal, one had a concentration of 120 µg/L, which is above the EPA's Reference Dose Limit of 100 µg/L. Atrazine was detected at a concentration of 1.1 µg/L, which is below the EPA MCL of 3.0 µg/L. Dacthal and atrazine are herbicides primarily used for control of perennial and/or annual weeds.

Results from the second phase monitoring indicated an increase in dacthal detections with 15 of 16 wells (94%) showing positive results (Figure 3 and Table 1). Two of the wells (the resampled well from the first monitoring and one additional well) showed levels of dacthal (110 µg/L) that exceeded the EPA's Reference Dose Limit of 100 µg/L. The average concentration of dacthal from the 16 wells sampled during the follow-up monitoring was 36.9 µg/L (Table 2).

Volatile Organic Compounds

Two volatile compounds, 1,2-dichloropropane and 1,2,3-trichloropropane were detected in both first and second phase monitoring. These two volatile compounds are believed to be found in insecticidal fumigants as either an active ingredient, inert, or impurity (Whitney et al., 1992). From the initial monitoring, only two wells contained 1,2-dichloropropane with concen-

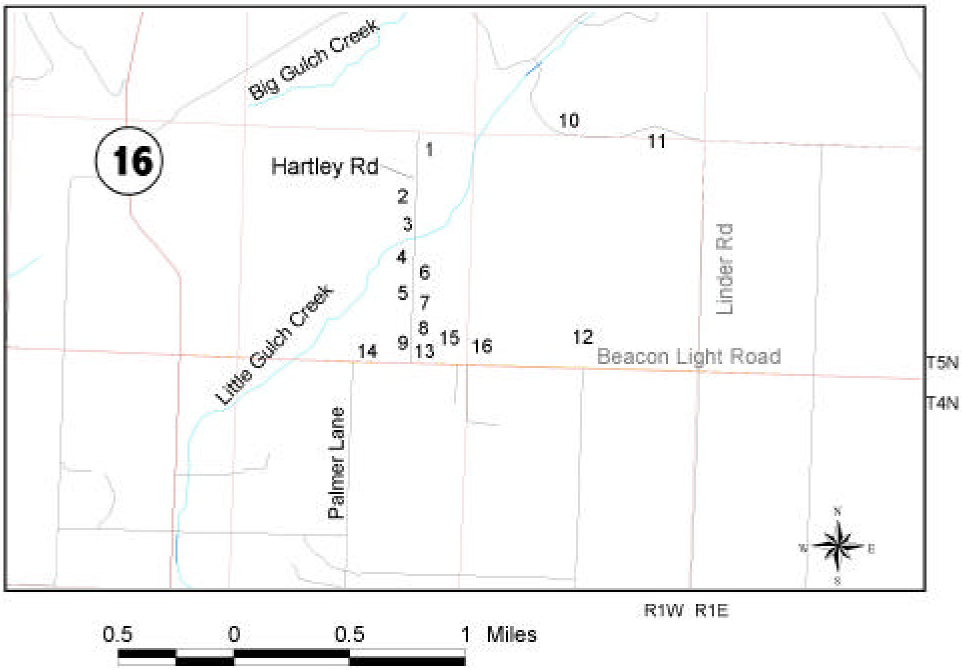

Figure 3. Location map of domestic wells sampled during phase two of ISDA ground water monitoring. Well identification number on map corresponds to identification number in Table 1.

MAP I.D.	NITRATE mg/L	DACTHAL ug/L	1,2 DICHLOROPROPANE ug/L	1,2,3 TRICHLOROPROPANE ug/L
1	1.10	1.30	BDL	BDL
2	12.00*	42.00	BDL	2.00
3	14.00*	38.00	0.81	6.60
4	0.50	9.30	4.50	1.20
5	42.00*	110.00	2.00	19.00
6	39.00*	110.00	1.70	15.00
7	36.00*	57.00	0.51	8.60
8	28.00	62.00	1.70	12.00
9	1.50	3.30	0.63	0.33
10	1.30	BDL	BDL	BDL
11	BDL	0.70	BDL	BDL
12	16.00*	29.00	1.20	11.00
13	11.00*	8.9.00	0.27	2.70
14	42.00*	82.00	1.50	18.00
15	15.00*	19.00	0.66	4.90
16	1.70	1.40	BDL	0.63

BDL = Below estimated detection limit of laboratory.

Table 1. Phase 2 monitoring results conducted in the summer and fall of 1995 by ISDA. Map identification. number corresponds to identification number on map in Figure 3.

trations of 1.8 and 1.4 µg/L, respectively. Neither of these detections exceeded the EPA's MCL of 5 µg/L.

There were four detections of 1,2,3-trichloropropane (0.68, 2.7, 5.6 and 19.0 µg/L) during the first round of sampling, but the concentrations did not exceed the EPA's Reference Dose of 60 µg/L for safe drinking water.

The results from follow-up monitoring indicated that 10 out of 16 wells (62%) showed positive detections for 1,2-dichloropropane and 12 out of 16 wells (75%) were positive for 1,2,3-trichloropropane. Again, as with the initial monitoring, none of the detections exceeded the EPA's MCL for 1,2-dichloropropane (5 µg/L) or the Reference Dose (60 µg/L) for 1,2,3-trichloropropane (Table 1).

Conclusions

Twenty domestic wells were sampled during the first phase of ISDA monitoring in Spring 1995. The results of this study showed that 15 wells (75%) showed detections for nitrate but only one (46 mg/L) was over the EPA's established MCL of 10 mg/L. Two wells were positive for dacthal and the volatile compound 1,2-dichloropropane. Four wells were positive for 1,2,3-trichloropropane. One well during this study was severely impacted (nitrate 46 mg/L, dacthal 120 µg/L, 1,2-dichloropropane 1.80 µg/L, and 1,2,3-trichloropropane 19.00 µg/L), which represents an elevated health risk.

The result of second phase, follow-up monitoring indicates a more severe contamination pattern along Beacon Light Road, in the vicinity of Hartley Road and also along Hartley Road. There is additional concern in this area of nitrate, dacthal, atrazine, 1,2-dichloropropane, and 1,2,3-trichloropropane contamination. The results showed 15 out of 16 wells (94%) had positive detections for nitrate. In addition, 10 out of 16 wells had nitrate levels above the established MCL of 10 mg/L. Dacthal was present in 15 out of 16 wells (94%) with two of the wells exceeding the EPA Reference Dose of 100 µg/L. The VOC 1,2-dichloropropane was present in 11 of 16 wells (69%) and the VOC 1,2,3-trichloropropane was present in 13 of 16 wells (81%). The concentrations of the two VOCs did not exceed the MCL or Reference Dose in any of the wells.

Recommendations

ISDA recommends a variety of actions to be taken by landowners, producers, agencies and local governments to mitigate and prevent further contamination of the aquifer in the project area. Also, citizens living in the area and agencies should take measures associated with wells, well drilling, and drinking water management to prevent adverse health affects.

Agricultural, Agrichemical, and Animal Waste Management

ISDA recommends that measures to reduce nitrate and pesticide impacts on ground water be addressed and implemented. The ISDA recommends that:

- Producers and agrichemical professionals conduct nutrient, pesticide, and irrigation water management evaluations especially north of Beacon Light Road where sandy soil conditions are present.
- Producers follow the Natural Resources Conservation Service (NRCS) Nutrient Management Standard (590) when using commercial fertilizers and/or animal waste.
- Producers and Confined Animal Feeding Operations (CAFOs) manage animal waste in a manner not to impact ground water. Ground water protection measures are necessary when storing, handling, hauling, and applying animal waste. For technical assistance, ISDA Technical Services Engineers and certified nutrient management planners can assist.
- Producers, noncrop applicators, and agrichemical dealers evaluate pesticide storage, containment, mixing, loading, rinsing, disposal, and application practices in the project area.
- Pesticide products that are least likely to leach be chosen for the soil type in this project area.
- Producers consider utilizing Integrated Pest Management (IPM) techniques in this area.
- Applicators and homeowners assess lawn and garden practices, especially near wellheads.
- Local residents assess animal and animal waste management situations near wellheads.
- Homeowners manage private septic systems properly.
- Applicators assess current pesticide application practices to non-crop areas (examples: roadsides, canal banks, driveways, etc.).
- Applicators consider an alternative herbicide when planning to use dacthal for weed control.

Monitoring

To determine if current agricultural and pesticide application practices are contributing to ground water degradation and to locate other potential contaminant sources, the ISDA recommends continued and more intensive monitoring in the project area.

Monitoring efforts could include, but not be limited to:

- The installation of monitoring wells in the area to determine extent of contamination, sources of contamination, and track land management BMPs over time.
- The continuation of ground water monitoring from domestic wells to track changes over time related to nutrients, common ions, and pesticides.
- Further isotope testing to determine nitrate sources.
- Soil sampling and soil pore water sampling for nutrient and pesticide testing associated with nutrient and pesticide management planning.

Well Testing, Construction, and Management

Domestic drinking water wells within the project area should be protected to provide the best possible drinking water. The ISDA suggests the following options:

- Residents sample their own wells for nitrate on a regular basis.

- Activities near wellheads be done in a manner not to impact well water quality.
- Homeowners consider using the Idaho Association of Soil Conservation Districts Farm & Home*A*Syst program (208-338-4321) to conduct self assessments related to wellhead protection.
- Construction of new wells or deepening of existing wells in the area be completed with the appropriate planning and design considerations to provide potable water.
- IDWR consider establishing a *well drilling area of concern* for this area.

Ground Water Protection and BMP Response Effort

The ISDA recommends that the Ada Soil and Water Conservation District lead a coordinated local response process to create a plan of action to address these ground water contamination issues. The soil and water conservation district should work with local land owners, agrichemical professionals, CAFO operators, Ada County, the City of Eagle, and agencies to implement this process and seek funding to support the implementation of these and other recommendations. The ISDA will support these local partners in seeking funding and implementing a comprehensive program.

References

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